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(54) Title: **MICROWAVEABLE FOOD COATING**

(57) Abstract: This invention relates to a process for the preparation of a crumbed food product which includes a crispy crumbed coating after microwave cooking. The invention also includes compositions used in the process. The method of the invention may be employed with all kinds of food product, but the preferred substrates are kept frozen at or below minus 18 °C prior to processing. The method includes: dipping the foodstuff in a dipping pre-mix solution including 1 to 10 % of dry mixture including starch, protein, gum, phosphate, emulsifier and/or salt; coating the dipped foodstuff in a pre-dust including flour, starch, protein, gum and/or salt; covering the pre-dust-coated foodstuff with a batter; applying breadcrumbs to the battered foodstuff; flash frying the crumbed foodstuff; and freezing the flash-fried product. The dipping pre-mix improves adhesion of pre-dust to the product, hydrates the pre-dust to create a surface which facilitates adhesion of the batter and, in combination with the pre-dust and batter, forms a layer which gels during flash frying to retard moisture migration from the substrate to the outer crumb coating, as well as providing resistance to freeze and thaw cycles.

MICROWAVEABLE FOOD COATING

TECHNICAL FIELD

5 This invention relates to a process for the preparation of a crumbed food product which includes a crispy crumbed coating after microwave cooking. The invention also includes compositions used in the process. The process has particular application for frozen food product.

10 BACKGROUND

 Crumbed fish, meat, poultry and vegetables are well known and very popular. The use of microwave ovens for cooking has become increasingly popular because it is fast and convenient. Moreover, it provides an alternative to
15 cooking with oil or fat and results in foods having lower oil or fat content. This is nutritionally attractive.

 Most crumbed food products currently on the market require cooking by frying, grilling or baking and are not designed for microwave cooking. Although
20 some crumbed food products are claimed to be suitable for microwave cooking, when these food products are cooked in a microwave oven, the crumb coating becomes soft and soggy. Furthermore, generally these crumbed food products do not achieve a golden colour coating after microwave cooking. These drawbacks affect the acceptability of crumbed food products when they are
25 cooked by microwave oven.

 The softening of coatings may be caused by moisture migrating from the substrate during microwave cooking and being absorbed by the dry breadcrumbs on the surface. There could also be moisture absorption into the batter. Further
30 absorption of moisture into the crumbs possibly results from the condensation of steam in the cool microwave oven. Thus, an ability to control the movement of moisture in crumbed food products during microwave cooking would result in a superior product.

The usual method of preparing crumbed food products has not changed for many years. It generally includes pre-dusting, battering and crumbing. Many patents exist which relate to particular combinations of ingredients for one or more of these components, and/or the conditions of processing. One such
5 patent is International Patent Application No. PCT/GB92/01559 (WO 93/03634) which discloses a food product with a microwaveable coating. The process is applied to fresh food and involves the use of pre-dust comprising an admixture of at least one particular starch and at least one particular cellulose gum. The pre-dusted food is then coated with a batter comprising a starch and a cellulose
10 gum which gels upon heating in the presence of moisture. Optionally the battered foodstuff may be crumbed prior to frying and subsequent cooling.

OBJECT OF THE INVENTION

15 It is an object of the present invention to provide a method of manufacture of a microwaveable food product, and compositions therefore, which reduces or overcomes at least some of the above-mentioned problems, or which at least provides the public with a useful alternative.

20 Other objects of the invention may become apparent from the following description which is given by way of example only.

SUMMARY OF THE INVENTION

25 According to one aspect of the present invention there is provided a method of preparing a microwaveable foodstuff, the method including:

- dipping the foodstuff in a dipping pre-mix solution including 1 to 10% of dry mixture including starch, protein, gum, phosphate,
30 emulsifier and/or salt,

- coating the dipped foodstuff in a pre-dust including flour, starch, protein, gum and/or salt,
- covering the pre-dust-coated foodstuff with a batter,
- 5 - applying breadcrumbs to the battered foodstuff,
- flash frying the crumbed foodstuff; and
- 10 - freezing the flash-fried product.

In a preferred form of the process of the invention the foodstuff may be frozen prior to dipping.

15 In one preferred form the dipping pre-mix may contain 1-15% dry weight protein.

Preferably the dipping pre-mix may contain 5 to 20% dry weight starch.

20 Preferably the dipping pre-mix may contain 0.5 to 5% dry weight gum.

Preferably the dipping pre-mix may contain 10 to 50% dry weight phosphate.

25 Preferably the dipping pre-mix may contain 10 to 50% dry weight salt.

Preferably the dipping pre-mix may contain 0.1 to 1.0% dry weight emulsifier.

30 In a preferred form the protein of the dipping pre-mix may be soy protein and/or milk protein.

Preferably, the starch of the dipping pre-mix may be pre-gelatinisation waxy maize starch.

5 Preferably, the gums of the dipping pre-mix may be guar gum and/or cellulose derivatives.

Preferably, the phosphates of the dipping pre-mix may be sodium tripolyphosphate and/or sodium acid pyrophosphate.

10 Preferably, the emulsifiers of the dipping pre-mix may be mono- and/or di-glycerides of fat forming fatty acids and/or sodium stearyl lactylate.

Preferably, the dipping pre-mix may include a phosphoric or acid phosphate buffer.

15 Preferably, in the process of the invention the dipping pre-mix may be maintained a low temperature, more preferably in the range 6 to 10°C.

20 Preferably, the foodstuff may be dipped in the dipping pre-mix for 10 to 60 seconds.

25 In a further preferred form of the invention the pre-dust may contain 50 to 97% flour, 2 to 6% salt, 0 to 5% protein, 0 to 75% starch and 0.5 to 23% gums.

30 In a further preferred form the batter may include substantially: 30 to 80% dry weight of high amylose starch, 5 to 35% dry weight other starch, 15 to 65% dry weight flour, and 0.5 to 5% dry weight, each, of gums, reducing sugar and/or proteins, and 2 to 6% dry weight salt.

Preferably, the batter may have a water to solids ratio in the range substantially 1.5 to 2.5.

Preferably, in the process of the invention the temperature of the batter may be maintained in the range of substantially 6 to 10°C.

Preferably, the batter may have a viscosity in the range of substantially
5 800 to 1100 cps.

In a further preferred form of the invention the breadcrumbs may be derived from bread containing 5 to 45% corn flour based on total flour weight, more preferably 10 to 40%.

10

Preferably, the breadcrumbs may include at least 1.5 to 7.5% of wheat gluten based on the weight of flour, more preferably 4 to 7.5%.

Preferably, the breadcrumbs may further include wheat flour; preferably
15 containing 9 to 11.5% protein.

Preferably, the breadcrumbs may have a moisture content in the range 7 to 10.5%, more preferably 7 to 9%.

20 Preferably, the breadcrumbs may be selected to have a majority (75 to 90%) of smaller particles and a minority (10 to 25%) of larger particles.

In one preferred form the breadcrumbs may have a particle size whereby 100% of particles pass 3.35mm aperture sieve, 80% pass 2.26mm aperture
25 sieve and at least 90% are held on 1.18mm aperture sieve.

In an alternative form the breadcrumbs may have a particle size whereby 100% of particles pass 2.36mm aperture sieve, 85% pass 2.00mm aperture sieve and at least 95% are held on 1.18mm aperture sieve.

30

In one preferred form of the invention the crumb-coated foodstuff may be flash-fried at a temperature in the range 180°C to 200°C for 30 to 60 seconds.

Preferably the flash-fried product may be blast frozen for 20 to 45 minutes at -21°C or below.

According to a further aspect of the invention there is provided a dipping
5 pre-mix solution for use in the preparation of a microwaveable foodstuff, said
dipping pre-mix solution including substantially 1 to 10% of dry mixture
including substantially: 1 to 10% dry weight protein, 5 to 20% dry weight
starch, 0.5 to 5% dry weight gum, 10 to 50% dry weight phosphate, 10 to
50% dry weight salt and 0.1 to 1% dry weight emulsifier.

10

According to a further aspect of the invention there is provided a batter
for use in preparing a microwaveable foodstuff, said batter including
substantially: 30 to 80% dry weight of high amylose starch, 15 to 65% dry
weight of flour, 5 to 35% dry weight of other starch, 0.5 to 5% dry weight of
15 gum, 0.5 to 5% dry weight of reducing sugar, 0.5 to 5% of dry weight protein
and 2 to 6% dry weight of salt.

According to a further aspect of the invention there is provided a high
density, compact texture bread crumb for use in preparing a microwaveable
20 foodstuff, said breadcrumb having a majority (substantially 75 to 90%) of
smaller particles and a minority (10 to 25%) of larger particles.

Other aspects of the invention may become apparent from the following
description which is given by way of example only and with reference to the
25 accompanying examples.

DETAILED DESCRIPTION OF THE INVENTION

The process of the present invention is useful for all kinds of food
30 products including, but not limited to, fish, poultry, seafood, vegetables, roschi
and lasagnes. It may, for example, be used in the preparation of fish cakes, fish
patties and fish portions cut from an uncooked, reformed, processed, frozen fish
block. The preferred poultry embodiment involves pieces of frozen poultry

breast, minced and reformed into nuggets or patties. Examples of vegetables suitable for the process include frozen potato hash browns, potato cakes, potato chips and mushrooms. Preferred seafood embodiments include frozen squid rings, mussels, scallops and crab sticks. Examples of roschi and lasagnes suitable for the process include frozen or unfrozen chicken, beef, ham, bacon, cheese, vegetable and/or blends, with or without existing crumb coating.

In all cases, the preferred substrates are kept frozen at or below -18°C prior to processing.

10

In broad terms, the process of the invention involves the taking of the frozen substrate, dipping it in a dipping pre-mix solution for 10 to 60 seconds, coating the dipped substrate in a pre-dust, immersing the dusted product in a batter slurry, coating the battered product in breadcrumbs, flash frying this coated product and then blast freezing the product.

The dipping pre-mix solution improves adhesion of pre-dust to the product, hydrates the pre-dust to create a surface which creates greater adhesion of the batter and, in combination with the pre-dust and batter forms a layer which gels during flash frying to retard moisture migration from the substrate to the outer crumb coating, as well as providing resistance to freeze and thaw cycles.

Dipping Pre-Mix Solution

25

The dipping pre-mix solution contains 1 to 10% of dry mixture including starches, proteins, gums, phosphates, emulsifiers and/or salts. The starches may be wheat, maize, corn, tapioca, rice or potato starch, or a blend of these. Preferred starch is pre-gelatinised waxy maize starch which is cold water soluble and has thickening, stabilising and suspending properties in an aqueous medium without cooking. The starch aqueous forms a smooth, short-textured and opaque gel upon heating.

The proteins used in the dipping pre-mix solution may be milk protein, wheat gluten, soy protein, egg albumin, corn protein, gelatin or a blend of these. The preferred proteins are milk protein, egg albumin and/or soy protein which are cold water soluble, form an adhesion gel and have water binding ability.

5

The food gums included in the dipping pre-mix solution may be selected from carrageenan, sodium alginate, methylcellulose, carboxymethylcellulose, hydroxypropylmethylcellulose, guar gum, xanthan gum or a blend of these. The preferred gums are xanthan gum, methylcellulose and guar gum which have the required properties of viscosity adjustment, suspension of solids and water-holding capacity. The gums also form film, contribute to freeze and thaw stability, prevent moisture migration, improve coating adhesion and reduce oil absorption.

10

15

The phosphates used in the dipping pre-mix solution may be monocalcium phosphate, sodium metaphosphate, sodium triphosphate, sodium acid pyrophosphate, potassium triphosphate or a blend of these. Sodium triphosphate and sodium metaphosphate are the preferred phosphates as they may form cross-links with starches, especially those made from waxy maize and potatoes, to provide gelatinisation, viscosity and textured properties, and thus improve resistance to freeze and thaw cycles, high temperature, acidity, and improve stability to mechanical forces.

20

The pH of the dipping pre-mix solution may be in the range 5.5 to 7.5.

25

In the process of the invention the dipping pre-mix solution is maintained at a temperature lower than room temperature, and preferably at a temperature in the range 6 to 10°C.

Pre-Dusting Composition

30

The pre-dust includes flours, starches, proteins, gums, and/or salt. It provides a cross-bridge or interfacial layer between the dipping pre-mix solution and batter, and thereby improves batter adhesion. The preferred flours are

wheat, corn or rice flour, or a blend of these. The preferred starches are corn and wheat starch, or a blend of these. The preferred proteins are soy protein, egg albumin powder, wheat gluten and gelatin or a blend of these. The preferred gums may be selected from guar gum, methylcellulose, hydroxypropyl-methylcellulose or a blend of these.

The pre-dust will preferably contain 50 to 97% of flours, 2 to 6% salt, 0 to 5% protein, 0 to 75% starch and 0.5 to 23% gums.

10 Batter

The batter may include flours, starches, proteins, gums, reducing sugars, salt and water. The batter coating forms an adhesion layer between the pre-dust and the breadcrumbs. It also contributes to colour, adhesion, taste and flavour in the finished product. Furthermore, the batter coating, in combination with the dipping solution and pre-dust is designed to retard moisture movement into the breadcrumbs from the food, thus improving the crispness and reducing oil absorption. The preferred starches may be high amylose starch, maize and tapioca starch. A high amylose starch is one containing at least 50% amylose. Preferably the batter may include 30 to 80% high amylose starch based on the weight of dry mixture. It may further include 5 to 35% of other starches.

The preferred gums included in the batter may be selected from methylcellulose, sodium alginate, guar gum and xanthan gum. The reducing sugars may be maltose, fructose, lactose, dextrose or xylose, but preferably xylose and/or dextrose.

The viscosity of the batter affects the nature of the final product since the batter is directly proportional to the final weight of the product. In addition, the viscosity affects the texture, adhesion, colour, flavour, oil absorption and crispness of the coating. The preferred ratio of water to solid in the batter is 1.5

to 2.5. The preferred viscosity of the batter may be in the range 800 to 1100 cps, at a temperature lower than room temperature, and preferably at a temperature of 6 to 10°C, to provide a uniform coating.

5 Breadcrumbs

As the surface coating of the crumbed food product, the breadcrumbs contribute to the colour, texture, flavour and crispness of the coating. The breadcrumbs need to have sufficient strength and integrity to adhere to the batter coated food and create uniform cohesion. Whether the product is in a raw, pre-cooked or cooked state, it must be able to withstand the normal rigors of line production, including flash frying, freezing, packaging, storage, transportation and handling.

The preferred breadcrumbs are formed from specially baked bread having a high density and compact structure. The bread preferably contains wheat flour, corn flour, soy flour, high amylose starch, wheat gluten, salt, sugar and colouring. The bread may preferably contain 5 to 45% cornflour based on the total flour weight. The high density and compact structure of the bread from which the crumbs are formed reduces oil and moisture absorption, thus improving crispness and achieving a preferred golden colour.

The breadcrumbs have a moisture content preferably in the range 7 to 10.5%.

Particle size is important for ensuring crispy texture and appropriate adhesion and in determining the preferred colour in the final cooked product. However, the average required particle size will be different for different types of food. An important factor is that the breadcrumbs include a majority of smaller particles and a proportion (10 to 25%) of larger particles.

The preferred particle sizes for a product requiring coarser breadcrumbs may be:

- 100% pass 3.35mm aperture sieve
- 5 80% pass 2.36mm aperture sieve
- ≥ 90% held on 1.18 mm aperture sieve

A preferred particle size of breadcrumb for a product requiring medium breadcrumbs is:

- 10 100% pass 2.36mm aperture sieve
- 85% pass 2.00 mm aperture sieve
- ≥ 95% held on 1.18 mm aperture sieve.

15 Processing

A selected frozen food product (substrate) which has been dipped, pre-dusted, battered and crumbed is then flash fried in a continuous oil fryer at 180 to 200°C for approximately 30 to 60 seconds. It will be appreciated that the time of flash frying will depend on the nature and size of the substrate. The purpose of flash frying in oil is to form a gel and seal the coatings, to achieve optimum coating adhesion and crispness at high temperature. The flash frying also inhibits dehydration during frozen storage and improves the shelf-life of the frozen crumbed food product. The desirable characteristics of golden colour, oily taste and crispness depends on the temperature of oil, the time of flash frying and the types of oil employed. Preferably vegetable oil such as palm oil, canola oil, peanut oil, soya bean oil or a blend of these may be used, at a temperature of 190 to 200°C for 30 to 60 seconds.

30 Following flash frying the product may be blast frozen for 20 to 45 minutes at -21°C to -28°C, before packaging for frozen storage at or below -18°C.

The crumbed product can be cooked in a microwave oven on a porcelain plate or other microwave-proof container from a frozen state. It will be appreciated that the cooking time in a microwave oven to produce the preferred crispy and golden coloured product will depend on the power of the microwave and the nature and size of the substrate.

Product Characteristics

Magnetic resonance imaging (MRI) is a non-destructive and non-invasive technique enabling the detection of changes in the distribution and mobility of water in foods during storage. MRI mapping was performed on fish fillets processed in accordance with the method of the invention, to investigate water migration into the crumbed coating and water distribution and mobility in crumbed fish.

15

MRI showed that the mobility of water in the fish fillets portion of microwaved crumbed fish fillets decreased considerably and the mobility of water of the coating of microwaved crumbed fish fillets decreased slightly during storage. The low mobility of water in the coating correlates with the observed crispness of the microwaved fish product.

20

Sensory evaluation of crumbed fish fillets was carried out by a trained panel. The characteristics evaluated included appearance (colour, oiliness, moistness and particle size) and texture (crispness, oily mouth feel, moistness and chewiness). Sensory evaluation was performed on two microwaveable crumbed fish prototypes by comparison to a benchmark-ovenable crumbed fish and control fish fillets. The control fish fillets used a commercially available pre-dust composition, batter and breadcrumbs. The control fish fillets were dipped in pure water prior to pre-dusting, and were then processed in the same way as the crumbed fish fillets of the invention.

25

30

The sensory evaluation of crumbed fish indicated that the microwaveable crumbed fish was less moist and less oily in appearance and

texture than the benchmark-ovenable crumbed fish and the control fish fillets. It also had a better colour and a crispier coating than the control crumbed fish cooked by microwave oven.

5 Adhesion of a crumbed coating to food is an important factor for overall texture of the crumbed product. Adhesion consists of chemical and physical binding of a coating both to its constituents and to the food it coats. The binding structure between a coating of the present invention and a fish product was visualised by scanning electron microscopy (SEM). The results showed that
10 the extent of adhesion was dependent on the ingredients used in the coating formulation, the pre-cooking conditions (eg, temperature and time of flash frying), the structure of the food itself and the nature of the breadcrumb particles. The method of cooking the final product was also a factor. The components of the dipping solution, pre-dust, batter and breadcrumbs used in
15 the present invention were selected to contribute to the adhesion of the coating to the product.

The process and components of the invention will now be described with reference to specific examples.

20

Example 1

Frozen fish fillets were prepared according to the method of the invention using a dipping solution, pre-dust, and batter having the ingredients
25 shown in table 1.

The temperature of the dipping prep-mix solution was in the range 6 to 8°C and the pH was approximately 6.5. The dipping pre-mix solution contained 10% dry mix with water. The fish fillets were dipped in the dipping pre-mix
30 solution for 10 to 30 seconds and then drained for 5 to 15 seconds at room temperature prior to pre-dusting. The fillets were then immersed in batter at 6 to 8°C for 5 to 30 seconds, drained for a further 5 to 15 seconds at room temperature and then crumbed. The crumbed product was flash fried for 40

seconds at 190°C. After removal from the fryer the product was blast frozen for 30 to 45 minutes at -21°C to -28°C.

Table 1

5

<u>DIPPING SOLUTION</u>	
Ingredient	% by weight
Sodium Tripolyphosphate	50
Sodium Chloride	30
Pre-gelatinised Starch	10
Soy Protein	6.5
Guar Gum	3
Emulsifier	0.5
Total Dry Mix Content	10
<u>PRE-DUST</u>	
Wheat Flour	57
Corn Flour	20
Rice Flour	20
Sodium Chloride	2
Cellulose Gum	0.75
Guar Gum	0.25
<u>BATTER</u>	
Wheat Flour	36
High Amylose Starch	50
Maize Starch	10
Sodium Chloride	2
Cellulose Gum	1
Dextrose	1
Dry Mixture: Water Ratio	1:2

The proportions of ingredients in the bread used in the breadcrumbs was: wheat flour 1800g, corn four 1200g, high amylose starch 105g, wheat

gluten 225g, sodium chloride 60g, sugar 45g, dry yeast 90g, bread improver 6g, annatto colour 3g and water 1950g. The particle size selection could be either of the coarser or medium breadcrumbs described above.

5 Example 2

The process of the invention was employed for preparing microwaveable fish patties. Details of the process were as for Example 1, above, but the ingredients/composition of the dipping pre-mix solution, pre-dust and batter were
 10 as shown in Table 2:

Table 2

<u>DIPPING SOLUTION</u>	
Ingredient	% by weight
Sodium Tripolyphosphate	33.3
Sodium Chloride	33.3
Pre-gelatinised Starch	16.7
Soy Protein	6.2
Guar Gum	5
Milk Protein	5
Emulsifier	0.5
Total Dry Mix Content	6
<u>PRE-DUST</u>	
Wheat Flour	56
Maize Starch	20
Rice Flour	20
Sodium Chloride	2
Soy Protein	1
Cellulose Gum	1

BATTER	
Wheat Flour	35
High Amylose Starch	60
Sodium Chloride	2
Sodium Alginate	1
Dextrose	0.5
Cellulose Gum	0.5
Milk Protein	1
Total Dry Mixture: Water	1:2.1

The proportions of ingredients in the bread used in the breadcrumbs was: wheat flour (2400g), corn flour (600g), high amylose starch (105g), wheat gluten (225g), sodium chloride (60g), sugar (45g), dry yeast (90g), bread improver (6g), annatto colour (3g) and water (1890g). The particle size selection could be either of the coarser or medium breadcrumbs described above.

The pre-dust, batter and breadcrumbs used in Examples 1 and 2 proved equally suitable for fish fillets or fish patties.

Where in the foregoing description reference has been made to specific components or integers of the invention having known equivalents then such equivalents are herein incorporated as if incorporated as if individually set forth.

Although this invention has been described by way of example and with reference to possible embodiments thereof it is to be understood that modifications or improvements may be made thereto without departing from the scope or spirit of the invention.

CLAIMS

1. A method of preparing a microwaveable foodstuff, the method including the steps of:
- 5
- dipping the foodstuff in a dipping pre-mix solution including substantially 1 to 10% of dry mixture including starch, protein, gum, phosphate, emulsifier and/or salt,
 - coating the dipped foodstuff in a pre-dust including flour, starch,

10

 - protein, gum and/or salt,
 - covering the pre-dust-coated foodstuff with a batter,
 - applying breadcrumbs to the battered foodstuff,
 - flash frying the crumbed foodstuff; and
 - freezing the flash-fried product.
- 15
2. A method according to claim 1 wherein the foodstuff is frozen prior to dipping.
3. A method according to either claim 1 or claim 2 wherein the dipping pre-
- 20
- mix includes substantially 1 to 15% dry weight protein.
4. A method according to any one of claims 1-3 wherein the dipping pre-mix includes substantially 5 to 20% dry weight starch.
- 25
5. A method according to any one of claims 1-4 wherein the dipping pre-mix includes substantially 0.5 to 5% dry weight gum.
6. A method according to any one of claims 1-5 wherein the dipping pre-
- 30
- mix includes substantially 10 to 50% dry weight phosphate.
7. A method according to any one of claims 1-6 wherein the dipping pre-mix includes substantially 10 to 50% dry weight salt.
8. A method according to any one of claims 1-7 wherein the dipping pre-mix
- 35
- includes substantially 0.1 to 1.0% dry weight emulsifier.

9. A method according to claim 1 wherein the dipping pre-mix further includes a phosphoric or acid phosphate buffer.
10. A method according to any one of claims 1-9 further including
5 maintaining the dipping pre-mix at a temperature in the range substantially 6 to 10°C.
11. A method according to any one of claims 1-10 wherein the foodstuff is dipped in the dipping pre-mix for substantially 10 to 60 seconds.
- 10 12. A method according to any one of claims 1-11 wherein the pre-dust includes substantially: 50 to 90% flour, 2 to 6% salt, 0 to 5% protein, 0 to 75% starch and 0.5 to 23 % gum.
- 15 13. A method according to any one of claims 1-12 wherein the batter includes substantially: 30 to 80% dry weight of high amylose starch, 5 to 35% dry weight other starch, 15 to 65% dry weight flour, and 0.5 to 5% dry weight, each, of gums, reducing sugar and/or proteins, and 2 to 6% dry weight salt.
- 20 14. A method according to claim 13 wherein the batter has a water to solids ratio in the range substantially 1.5 to 2.5.
- 25 15. A method according to either claim 13 or claim 14 wherein the batter is maintained at a temperature substantially in the range substantially 6 to 10°C.
- 30 16. A method according to claim 15 wherein the batter has a viscosity in the range of substantially 800 to 1100 cps.
17. A method according to any one of the preceding claims wherein the breadcrumbs are derived from bread in which at least 5% of the flour is cornflour.

18. A method according to claim 17 wherein the breadcrumbs have a moisture content in the range substantially 7 to 10.5%.
- 5 19. A method according to claim 18 wherein the breadcrumbs are selected to have a majority (75 to 90%) of smaller particles and a minority (10 to 25%) of larger particles.
- 10 20. A method according to claim 19 wherein the breadcrumbs have a particle size whereby 100% of particles pass 3.35mm aperture sieve, 80% pass 2.26 mm aperture sieve and at least 90% are held on 1.18mm aperture sieve.
- 15 21. A method according to claim 19 wherein breadcrumbs have a particle size whereby 100% particles pass 2.36mm aperture sieve, 85% pass 2.00mm aperture sieve and at least 95% are held on 1.18mm aperture sieve.
- 20 22. A method according to any one of the preceding claims wherein the crumb-coated foodstuff is flash-fried at a temperature in the range substantially 180°C to 200°C for substantially 30 to 60 seconds.
- 25 23. A method according to any one of the preceding claims wherein the flash-fried product is blast frozen for substantially 20 to 45 minutes at substantially minus 21°C or below.
- 30 24. A dipping pre-mix solution for use in the preparation of a microwaveable foodstuff, said dipping pre-mix solution including substantially 1 to 10% of dry mixture including substantially: 1 to 10% dry weight protein, 5 to 20% dry weight starch, 0.5 to 5% dry weight gum, 10 to 50% dry weight phosphate, 10 to 50% dry weight salt and 0.1 to 1.0% dry weight emulsifier.

25. A dipping pre-mix according to claim 24 wherein the protein is soy protein and/or milk protein.
26. A dipping pre-mix according to claim 25 wherein the starch is a pre-gelatinisation waxy maize starch.
27. A dipping pre-mix according to claim 26 wherein the gums include guar gum and/or cellulose derivatives.
28. A dipping pre-mix according to claim 27 wherein the phosphate includes sodium tripolyphosphate and/or sodium acid pyrophosphate.
29. A dipping pre-mix according to claim 24 further including a phosphoric or acid phosphate buffer.
30. A batter for use in preparing a microwaveable foodstuff, said batter including substantially: 30 to 80% dry weight of high amylose starch, 15 to 65% dry weight of flour, 5 to 35% dry weight of other starch, 0.5 to 5% dry weight of gum, 0.5 to 5% dry weight of reducing sugar, 0.5 to 5% dry weight of protein and 2 to 6% dry weight of salt.
31. A batter according to claim 30 having a water: solids ratio in the range substantially 1.5 to 2.5.
32. A batter according to claim 31 having viscosity in the range substantially 800 to 1100 cps.
33. A high density, compact texture breadcrumb for use in preparing a microwaveable foodstuff, said breadcrumb having a majority (substantially 75 to 90%) of smaller particles and a minority (10 to 25%) of larger particles.

34. A breadcrumb according to claim 33 having particle sizes whereby 100% of particles pass 3.35mm aperture sieve, 80% pass 2.26mm aperture sieve and at least 90% are held on 1.18mm aperture sieve.
- 5 35. A breadcrumb according to claim 33 having a particle size whereby 100% of particles pass 2.36mm aperture sieve, 85% pass 2.00mm aperture sieve and at least 95% are held on 1.18mm aperture sieve.
- 10 36. A method of preparing a microwaveable foodstuff substantially as herein described and with reference to the accompanying examples.
37. A dipping pre-mix solution substantially as herein described and with reference to the accompanying examples.
- 15 38. A batter substantially as herein described and with reference to the accompanying examples.
39. A breadcrumb substantially as herein described and with reference to the accompanying examples.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00141

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ⁷: A23P 1/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: A23P 1/08, A23L 1/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPIDS: A23P 1/08, A23L 1/ and keywords (protein, phosph, crumb, batter, flour, starch)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 54821/90 (LINDGREN PTY LTD) 8 November 1990 whole specification	1-23
X	US 4 842 874 (D'Amico et al.) 27 June 1989 whole specification	1-23
X	US 4 778 684 (D'Amico et al.) 18 October 1988 whole specification	1-23

☒ Further documents are listed in the continuation of Box C ☒ See patent family annex

<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>		<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search
31 October 2000

Date of mailing of the international search report
- 8 NOV 2000

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00141

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 755 392 (Banner et al.) 5 July 1988 whole specification	1-23
X	US 4 675 197 (Banner et al.) 23 June 1987 whole specification	1-23
A	WO 94/00029 (GENERAL MILLS, INC.) 6 January 1994 whole specification	1-23
A	US 5 576 036 (Pesheck et al.) 19 November 1996 whole specification	1-23
A	US 5 520 937 (Yasosky et al.) 28 May 1996 whole specification	1-23
A	US 5 281 432 (Zallie et al.) 25 January 1994	1-23
A	US 5 194 271 (Yasosky) 16 March 1993	1-23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00141

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see extra sheet attached

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-23

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ00/00141

Supplemental Box

(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of invention so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are four inventions as follows:

1. Claims 1-23 directed to a method of preparing a microwaveable foodstuff comprising the steps of:
dipping the foodstuff in a dipping pre-mix solution including substantially 1 to 10% of dry mixture including starch, protein, gum, phosphate, emulsifier and/or salt,
coating the dipped foodstuff in a pre-dust including flour, starch, protein, gum and/or salt,
covering the pre-dust-coated foodstuff with a batter,
applying breadcrumbs to the battered foodstuff,
flash frying the crumbed foodstuff; and
freezing the flash-fried product.
It is considered that this comprises a first "special technical feature".
2. Claims 24-29 directed to a solution (dipping pre-mix) including substantially 1-10% of dry mixture including substantially: 1-10% protein, 5-20% starch, 0.5-5% gum, 10-50% phosphate, 10-50% salt and 0.1-1.0% emulsifier. It is considered that this comprises a second "special technical feature".
3. Claims 30-32 directed to a composition (batter) including substantially: 30-80% of high amylose starch, 15-65% flour, 5-35% other starch, 0.5-5% gum, 0.5-5% reducing sugar, 0.5-5% protein and 2-6% salt. It is considered that this comprises a third "special technical feature".
4. Claims 33-35 directed a high density, compact texture breadcrumb having a majority (substantially 75-90%) of smaller particles and a minority (10-25%) of larger particles. It is considered that this comprises a fourth "special technical feature".

The objects of the invention are described at page 7, lines 17-22 of the specification. It is the working interrelationship of the dipping pre-mix, pre-dust and batter that appears to provide the solution to the problems of the prior art. None of the individual components achieve these alone. Claim 24 (invention 2) defines a solution per se which comprises known components. There is no "special technical feature" which links the solution of invention 2 with the method of invention 1. As demonstrated above, invention 1 does not necessarily require the batter of invention 3 nor the breadcrumb composition of invention 4. Furthermore, the batter of invention 3 and the breadcrumb composition of invention 4 are in no way formulated such that they are limited to the method of invention 1. Consequently, invention 1 does not share a technical feature with any of the other inventions. Finally, it is prima facie apparent that neither of inventions 3 or 4 share a technical feature with each other.

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2, does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ00/00141

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
AU	5482190	AU	54821/90		
US	4842874	US	4778684		
US	4755392	AU	38678/85	CA	1219763
		JP	60237950	US	4675197
WO	9400029	AU	45430/93	US	5362504
US	5576036	BR	9307219	EP	662785
		NZ	254648	WO	9407369
US	5520937	AU	69639/91	CA	2084893
		HK	1007938	WO	9201384
US	5281432	CA	2052969	EP	480433
				JP	4311356
END OF ANNEX					

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